Regenerative Thermal Oxidizer (RTO)

Process Overview

The Regenerative Thermal Oxidizer (RTO) unit is designed to remove typical combustion by products- Volatile Organic Compounds (VOC) and NO_x emissions from the Dryer exhaust. The RTO unit reduces air pollution emissions generated at the facility thereby complying with all state and federal air emission permit limits.

The RTO uses heat to promote oxidation. Oxidation is a chemical process which causes oxygen to react with organic compounds (VOC) to become carbon dioxide and water. This is the simple formula that explains oxidation:

VOC+oxygen+heat=water+carbon dioxide

Exhaust gases from the Dryer are pulled through the ductwork connecting the dryer to the RTO unit. The induced draft RTO Exhaust fan motor operates by a Variable Frequency Drive (VFD) which acts to maintain constant pressure in the inlet duct. The incoming exhaust gas passes through the media beds for preheating prior to passing around the flame of the burner. The oxidized gas stream then flows through the media bed (for heat reclamation) prior to being exhausted into the atmosphere.

Three sections of the RTO are dedicated to the down flow of clean heated exhaust air to the heat input side of the ceramic Heat Exchanger located in the middle section. After the clean exhaust air heats the incoming Dryer exhaust it exits the middle section, then the air exits to the plenum ID fan and stack.

Flow in the sections of the ceramic heat exchanger must be inverted regularly to retain heat. Otherwise combustion temperatures would eventually reach the exhaust section and damage the system. RTO dampers cycle to cause the flow inversion.

Natural gas is injected into the inlet duct prior to the Combustion Chamber. The introduced natural gas oxidizes flamelessly in the middle of the ceramic media. Gas Consumption is reduced since no combustion air is used. The Natural gas Injection system automatically modulates to control Combustion Chamber temperature at set point (field determined, but generally around 1600°F).

Design Values

RTO

Parameter	Design Value
Exhaust Dryer flow	52,815 scfm
Exhaust Inlet Temperature	240°F
Combustion Temperature	1500°F
Design Temperature High	1700°F
RTO Outlet Temerature	335°F
Thermal Efficiency	95%
Cycle Time	1 Minute
Burner Capacity	8mm btu/hr

Exhaust Fan

Parameter	Design Value
Type	Robinson, 600 HP
RPM/Rating	1780 rpm-3/60/4160

Combustion Blower

Parameter	Design Value
Type	Twin City, 15 HP
RPM/Rating	3600 rpm-3/60/460

Purge Fan

Parameter	Design Value
Type	Twin City, 40 HP
RPM/Rating	1800 rpm-3/60/460

Chapter 5

MAINTENANCE

Why good maintenance?

Lack of planned maintenance will cost you money. Poorly adjusted or improperly maintained combustion equipment uses more fuel and causes needless shutdowns. Unlike most mechanical devices, maladjusted and inefficient combustion equipment frequently continues to operate without breaking down. General maintenance is often overlooked with only necessary repairs being made when components become non-functional. Unfortunately, valuable fuel and heat losses go unnoticed, and even more serious; safety equipment can become inoperative with even more costly consequences.

Planned maintenance procedures involving periodic inspections of combustion equipment are the only means for assuring economy and safety of operation.

Combustion safeguards and interlocks do afford a measure of security; consequently, operators should never tamper with these when the operation seems faulty or appears to slow down. Accidents usually can be traced to indifferent maintenance of protective devices or failure to immediately and properly remedy defects.

One of the best ways to reduce maintenance requirements of combustion equipment is to provide a trained operator. A trained operator knows good operating practices and is aware of the costly consequences to production and the hazards of careless equipment manipulation. Only a qualified person should handle troubleshooting and preventative maintenance. It is wise to consult the equipment manufacturer for repair or replacement instructions on such equipment as flame combustion safeguards and electronic controls.

If you have any questions, or need any assistance, please feel free to contact our Service Department.

WARNING: PERIODIC CLEANING AND MAINTENANCE OF EQUIPMENT IS REQUIRED. FAILURE TO UNDERTAKE SUCH ACTION MAY CAUSE EQUIPMENT DAMAGE, IMPROPER FUNCTION, OR THE CREATION OF AN EXPLOSIVE FIRE HAZARD. THE CUSTOMER SHALL BE SOLELY RESPONSIBLE FOR ALL DAMAGES AND LOSSES INCURRED AS A RESULT OF IMPROPER MAINTENANCE OR FAILURE TO KEEP EQUIPMENT CLEAN.

General Maintenance Instructions

NOTICE: FOLLOW THE PROCEDURES OF THE PRECAUTIONS SECTION AND CONFINED SPACE REGULATIONS FOR ENTERING THIS UNIT.

1. Lubricate all the fan bearings, as necessary, per the manufacturer's instructions.
2. Lubricate all the fan motor bearings, as necessary, per the manufacturer's instructions.
3. Follow maintenance instructions as called out in the attached controller manuals.
4. Review the Vendor Bulletins/Instructions in this manual for instruction on individual components.
5. The following vendor information contains maintenance schedules for the components supplied:
    A. Hydraulic Power Unit(s)
    B. Fans
    C. Motors

D. Valves and Dampers

E. Pumps

F. ID Fan

5. Experience will dictate how frequently your process ducts and the RTO inlet and outlet ducts must be cleaned in order to prevent a hazardous accumulation of material. As a general recommendation, the RTO ducts should be cleaned whenever your process ducts are cleaned.

Monthly Inspection Points and Procedures

1. The burner is to be visually inspected. The inspector should note the flame pattern and color. The burner should show a continuous flame and an even pattern over the entire area of the burner(s). Patterns or colors contrary to those adjusted during commissioning indicate that a closer inspection and/or maintenance may be required. Periodic cleaning and inspection of the burner is a necessity. This should be performed at least annually or sooner if needed. Proper maintenance of the burner and incineration equipment is necessary for efficient and safe operation of the unit.

2. The hydraulic power unit and hydraulic system should be visually inspected for:

   A. Reservoir level

   B. Fluid leaks

   C. Erratic operations

   D. Pressure

   E. Filter visual indicators

3. Inspect exterior steel shell for possible signs of hot spots caused by insulation failure.

Please refer to the Vendor Bulletins/Instructions section for this component for more detailed maintenance instructions.

Annual Inspection Points and Procedures

To assure continued efficient operation, the following items should be inspected only during a period when the RTO is not in use and has been cooled to ambient temperature.

NOTICE: FOLLOW THE PROCEDURES OF THE PRECAUTIONS SECTION AND CONFINED SPACE REGULATIONS FOR ENTERING THIS UNIT.

1. Remove all access doors using caution not to damage the insulating materials.
2. Inspect refractory materials for signs of damage and perform repairs, if required.
3. Inspect the gas burner for cracks, plugged orifices, or residue. Clean each gas orifice as required.
4. Inspect all fan wheels and bearings and lubricate as required. Please refer to the Vendor Bulletins/Instructions section for this component for more detailed maintenance instructions.
5. Inspect all dampers for correct operation and lubricate as required. Please refer to the Vendor Bulletins/Instructions section for this component for more detailed maintenance instructions.
6. Replace the retention chamber thermocouples annually.
7. Inspect U.V. Detectors. Please refer to the Vendor Bulletins/Instructions section.
8. Check Spark Plugs for proper adjustment.
9. It is prudent to periodically inspect and test all safety devices to verify their integrity and operation.
10. Check inlet duct, outlet duct, lower canisters, and valves of RTO for build-up of material. Clean as required. More or less frequent cleaning may be required as described in the "General Maintenance Instructions" at the beginning of this section.
11. It is recommended that all plant safety procedures be followed for inspection of ducts for build-up with unit running on fresh air at low flow. **No personnel should be allowed to enter the unit for such inspections**. Ideally, the unit should be shut down and locked out before completing this type of inspection.

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12. A sample of the catalyst-coated ceramics must be collected annually following the procedures provided by the supplier and returned to the supplier for analysis.

Internal Insulation Replacement Procedure

Each insulation module is attached by means of a stud and retention nut system. Use the following procedure to replace any damaged block(s).

1. Locate the stud for the module requiring replacement.
2. Remove retention nut using a deep socket wrench.
3. Remove module while taking care to prevent damage to adjacent modules.
4. Remove the sleeve, nut and stud from the replacement module.
5. Insert the replacement module while taking care to prevent damage to adjacent modules.
6. Install retention nut using a deep socket wrench.

Please refer to the Vendor Bulletins/Instructions section for this component for more detailed installation instructions.